University of Bahrain
College of Information Technology
Department of Computer Engineering

ITCE 202: Digital Logic
Test 1

Time: 1 hour **Date: April 6th, 2004**

Show all your work.
DO NOT USE CALCULATORS

Q1-

a) **(8-points)** Represent the following decimal numbers as 8-bits signed binary numbers in sign-magnitude, one's complement and two's complement format.

Decimal	sign-magnitude	one's complement	two's complement
+ 79			
- 49			

b) **(4 points)** Convert from Octal to BCD $(3.4)_8$ = ( )$_{BCD}$

c) **(6 point)** Convert $(8A9D)_{16}$ = ( )$_4$
= ( )$_8$

d) **(6 points)** Perform the following addition in binary using 7-bit 2's complement representation. Indicate if there is an overflow.
(-31) + (-56)

e) **(6 points)** Perform the following addition in BCD
947 + 735

Q2-

a) **(10 points)** Draw the logic circuit that corresponds to the following logic function (Do not Simplify).

$$F = \overline{\left[\left(A + \overline{B.C}\right) \oplus \overline{\left(A+B+C\right)} \right] . \; A \; . \overline{C}} + D$$

b) **(7 points)** Simplify the following expression to a minimum sum of products.

c) **(8 points)** Given that $F = W.X. \left[Y.(\overline{X} + W) + \overline{Y. \; \overline{Z}} \right] + \overline{V}$

Use DeMorgan's theorem to find $\overline{F}$ and express $\overline{F}$ in a sum of products form.

Q3-Consider the following Boolean function:

$$F(A,B,C,D) = \sum m(0,2,4,5,7,8,10,14,15) + \sum d(6,13)$$

Express F in:

a) **(14 points)** Minimum Sum of products.
b) **(6 points)** Minimum Product of sums.

Q4- (25 points)
Given that:

$$F(A,B,C,D) = (B+C)(\overline{A}+\overline{C}+D)(\overline{A}+B)$$

a) Implement F as a minimum 2-level NAND gate network.
b) Using the minimum number of 2-input NOR gates only.